RECENT COLONISATION OF HERON ISLAND, SOUTHERN GREAT BARRIER REEF, BY THE MOURNING GECKO, *LEPIDODACTYLUS LUGUBRIS*

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Limpus, C.J., Limpus, D.J. & Goldizen, A. 1999 06 30: Recent colonisation of Heron Island, southern Great Barrier Reef, by the Mourning Gecko, *Lepidodactylus lugubris*. *Memoirs of the Queensland Museum* **43**(2): 777-781. Brisbane. ISSN 0079-8835.

The Mourning Gecko, *Lepidodactylus lugubris*, colonised Heron Island in the southern Great Barrier Reef in 1995. Although isolated individuals of a wide range of non-avian terrestrial wildlife species arrive on the island with cargo, this forested coral cay has no history of a successful colonisation by a terrestrial reptile. This gecko did not originate from the adjacent mainland or from a nearby island. It is likely that the gecko has arrived among a tourist's luggage. ❐ *Lepidodactylus, colonisation, Heron Island, Great Barrier Reef, Queensland, Australia.*

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This study reports the recent colonisation of Heron Island in the southern Great Barrier Reef (GBR) of Queensland by the Mourning Gecko, *Lepidodactylus lugubris*, and discusses the possible source of the founding individual(s). Heron I. is a forested coral cay, approximately 830m long and 300m wide, lying approximately 80km off the coast from Gladstone in the southern GBR. The island was formed from non-terrigenous sediments derived from the surrounding coral reef (Mather & Bennett, 1984). This and neighbouring islands formed when sea levels stabilised after the last Holocene transgression and they have never been connected to the mainland or to each other. There are no non-avian terrestrial vertebrates native to Heron I. or other islands of the Capricorn-Bunker Groups or on Lady Elliott I., another nearby coral cay to the south (Mather & Bennett, 1984). There has been no evidence of aboriginal habitation of these islands since European explorers discovered them in the early 1800s. There is no evidence of terrestrial reptiles native to the island prior to the continual European residency which commenced in 1925 with a turtle soup factory. The island village currently comprises a tourist resort, a research station and the Marine Parks Ranger Station. The discussion explores reasons why this recent colonising event by *L. lugubris* has been successful while other terrestrial reptilian colonisations have failed.

METHODS

One of us (CJL) has been a frequent visitor to Heron I. (23°26'S 151°55'E) and other islands of the Capricorn-Bunker Groups from 1962 up to the present and has examined the islands intermittently by day and night in search of terrestrial fauna. Geckos were captured by hand and measured (±0.01cm) for snout-vent length (SVL) and tail length from the anterior of the vent, using vernier calipers. SVL and tail length were summed for calculating total length. Each gecko was examined for presence of original or regrowth tail and for presence or absence of enlarged bulges of invaginated hemipenes on each side of the ventral base of the tail. Shelled oviducal eggs, visible through the ventral body wall, were counted. Additional data on the occurrence of the gecko on Heron I. were obtained through interviews with residents and regular visitors to the island. Information on the ports of origin of resort guests was obtained from interviews with management personnel at the resort.

RESULTS

The earliest records of a gecko resembling *L. lugubris* inhabiting Heron I. date from October 1995 when reports of geckos on the tourist resort buildings were recorded in wildlife sightings log books and a gecko was observed under bark of a dead *Casuarina equisetifolia* on the northern strand in front of the tourist resort (A. Congram, pers. comm.). The first sightings at the Marine Parks Ranger Station occurred in January 1996

(A. Phillott, pers. comm.). During our visit to Heron I. in late October – early November 1996, geckos were found to be common nocturnal foragers on the walls and ceilings of all illuminated buildings of the tourist resort. None was found on unlit buildings, on strand tree trunks or on the research station or Marine Parks buildings during spotlighting searches. Given the number of buildings with the gecko present and the numbers seen on individual buildings, the *L. lugubris* population on Heron I. in November 1996 would have consisted of hundreds of lizards. In August 1997, when the next search was made for the species, it was abundant on the lighted walls of buildings at the tourist resort, research station and Marine Parks base.

A captured sample of 45 *L. lugubris* was examined on 3-4 November 1996. None had enlarged bulges on the ventral base of the tail and all were presumed to be females. The geckos ranged in size from the smallest immature with SVL = 1.91cm (total length = 3.69cm) to the largest adult with SVL = 4.87cm (total length = 9.68cm). Four specimens were lodged in the Queensland Museum collection (QMJ62556-62559).

The smallest gecko with oviducal eggs measured SVL = 4.12cm. If this is taken as the minimum adult size, then there were 30 adult sized geckos. Twenty-five (83%) of them were adults based on the presence of oviducal eggs. Whether the remaining five adult-sized geckos were non-breeding adults or large immature individuals was not determined. Mean size of gravid geckos was SVL = 4.45cm (SD = 0.21, range = 4.12-4.87, n = 25). Of the gravid geckos, 22 (88%) had two oviducal eggs (one egg in each oviduct) and 3 (22%) carried a single oviducal egg. There was no knife-edge effect by size for the presence of oviducal eggs (Figure 1).

The high proportion of original tails within the sample (40/45) suggests that these geckos are not subjected to intense predation. Potential predators on Heron I. would be primarily from the avifauna: reef egret, buff-banded rail and sacred kingfisher. While egrets and kingfishers can be expected to eat any *L. lugubris* encountered by day, only the rails regularly foraged at night when the geckos were also active. However, geckos on walls and tree trunks would be mostly beyond the foraging range of the rails. Large spiders may prey on some very small geckos.

POTENTIAL SOURCES OF NON-AVIAN TERRESTRIAL INTRODUCTIONS

A wide range of items, including building materials, sand and gravel, food, furniture and machinery, have been shipped weekly to Heron I. from Gladstone on the adjacent mainland for decades. As a result, there has been a considerable potential for local wildlife to be introduced to the island. However, *L. lugubris* is not known from the mainland adjacent to Heron I. Recorded instances of introductions of other species to the island have been relatively infrequent. The introduced rat, *Rattus rattus*, was abundant throughout the island in 1962. Between 1963 and 1967, the rats were eradicated with a baiting program (R. Poulsen, pers. comm.). Heatwole (in Mather & Bennett, 1984) recorded 3 introductions of lizards to the island but identified only the dragon, *Pagona barbatus*. Within two weeks of introduction of roll-on, roll-off barging of cargo in the late 1970s, a *Bufo marinus* was captured on the island. A green tree frog, *Litoria caerulea*, regularly was heard calling from a septic system ventilator over a summer in the early 1990s. In recent years some snakes have been found and immediately killed on Heron I.: an eastern brown snake, *Pseudonaja textilis*, arrived in a palette of equipment in the summer of 1993-1994; a green tree snake, *Dendrelaphis punctulatus*, arrived among building materials during the summer of 1996-1997. In early 1997 a gecko resembling a *Gehyra* ran from a carton of vegetables that had recently arrived from the mainland (E. Grant, pers. comm.). The house mouse, *Mus musculus*, has become established on the island and eliminated by baiting and trapping on several occasions. In August 1997, house mice were common and widespread on Heron I. Human alterations to the island may have on occasions enhanced the survival of species that normally would not have survived for long after their arrival. For example, although not a case of unnatural arrival at Heron I., yellow-bellied sheathtail-bats, *Saccolaimus flaviventris*, had an extended residency on Heron I. in March-April 1992 facilitated by the opportunity to forage each night in the cleared area of the recently constructed open topped sewerage treatment tanks.

Although rodents have colonised other islands within the Capricorn-Bunker Groups (Northwest: *M. musculus*; Wreck: *R. rattus*; Faifax: *R. rattus.*) at various times during this century, there are no previous colonisations of any of the coral cays within a 100km radius of Heron I. by terrestrial

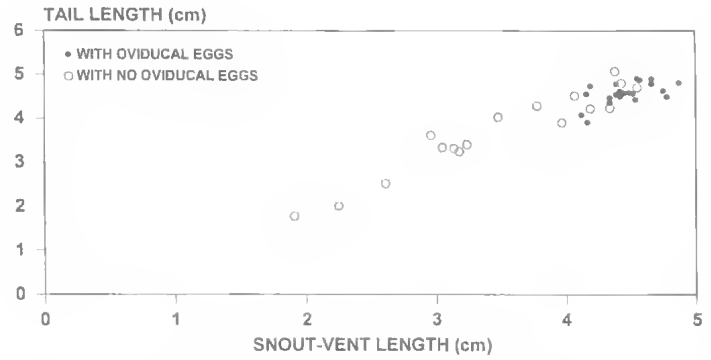

FIG. 1. *Lepidodactulus lugubris* at Heron Island: distribution by size, with and without oviducal eggs.

reptiles except for Wilson I. and Lady Elliott I. One species of terrestrial reptile occurs on Wilson I. (23°18'S 151°55'E), the Asian House Gecko, *Hemidactylus frenatus* (Heatwole, in Mather & Bennett, 1984). *H. frenatus* is not resident on the adjacent mainland or on adjacent islands. It has been a resident of Wilson I. since at least 1977 (CJL unpubl. data). For more than 30 years, the Heron I. tourist resort has conducted regular day visits to Wilson I., ~14km from Heron I. Food, rubbish and other items were repacked at Wilson I. and returned to Heron I. at the completion of each day's visit yet *H. frenatus* has not been recorded on Heron I. Lady Elliott I. (24°07'S,152°43'E) had been colonised by the 1960s by two species of terrestrial diurnal skink ('*Sphenomorphus tenuis*' [=*Eulamprus* sp. Greer, 1992] and *Cryptoblepharus virgatus*) which most probably had been transported to the island via human activities associated with guano mining and the manned lighthouse (Heatwole in Mather & Bennett, 1984). At that time Lady Elliott I. had been deforested and had a depauperate population of egrets, rails and other potential predators of these reptiles (P. Ogilvie, pers. comm.).

Rafting of wildlife to Heron and adjacent islands from the mainland following floods has been rarely observed. In the week following the extensive 1991 flooding of the Fitzroy River, 'small green frogs' were observed on marker buoys and floating hyacinth clumps on the perimeter of Heron Reef and freshwater turtles, *Chelodina longicollis*, came ashore on Heron I. and Northwest I. The latter were collected and returned to the mainland.

There has been an unconfirmed report of the release of geckos on Heron I. as part of a colonisation experiment in the late 1960s or early 1970s. The last sighting of geckos that may have been associated with this were recorded on the research station buildings in 1973. These geckos included a medium sized arboreal species that was most likely a *Gehyra*. Although searches of the island for geckos were made irregularly in the intervening period, no gecko population was found on the island until 1995.

Visitors to the Tourist Resort and Research Station and island residents returning from holidays all bring luggage when they arrive at Heron I. It is not uncommon for some items of luggage, especially dive equipment, to arrive unopened on Heron I. after having been packed at distant sites. Unfortunately, neither the use of colour patterns nor current mtDNA genetic analysis can provide the degree of resolution necessary to identify the site/country of origin for these *L. lugubris* (C. Moritz. pers. comm.). The capacity for this gecko to hitch-hike into new locations is illustrated by a SCUBA diver from the Heron I. tourist resort in September 1997 surfacing after a 30min dive at 10-12m depth on the outside of Heron I. Reef with an adult sized gecko crawling in her hair. The gecko was quite active and was returned to the island and released (E. Grant, pers. comm.). This particular gecko is presumed to have been transported from the island in the diving equipment.

DISCUSSION

Lepidodactylus lugubris occurs widely throughout the Indo-Pacific region in triploid asexually reproducing (parthenogenic) populations (Moritz et al., 1993, Radtkey et al., 1995). The species has been recorded previously from Australia from the islands in Torres Strait, from islands along the inner shelf of the northern Great Barrier Reef to as far south as the Barnard Is (17°40'S 146°11'E, Kluge, 1963) and from coastal mainland sites near Cape York, Portland Roads and the Port Douglas to Mission Beach area (Cogger, 1994; Ingram & Raven, 1991; CJL, unpubl. data). Within this distribution, this gecko appears to inhabit rocks, logs, trees and buildings, including beached boats, in the immediate vicinity of the strand (CJL, unpubl data). The Barnard Is population was first noted by Kluge (1963) on the

basis of two old (probably last century) specimens in the Macleay Museum and reconfirmed in 1969 (Australian Museum specimen, R49919. Glen Shea, pers. comm.). No previous records of *L. lugubris* were obtained from S of Mission Beach (17°56'S, 146°06'E) even though there were extensive searches for this species on islands and in coastal areas between Mission Beach and Townsville during 1976-1979 by Queensland National Parks and Wildlife Staff (CJL, unpubl. data).

The colonisation of Heron I. in 1995 by *L. lugubris* is the first successful colonisation of the island by a terrestrial reptile. Because *L. lugubris* does not occur on the adjacent mainland or nearby islands (Cogger, 1994; Mather & Bennett, 1984), it must have originated from a more distant site. Therefore, it is highly unlikely that the colonising geckos arrived by barge from the mainland. Similarly it is unlikely to have arrived by rafting on floating debris from the sea. It is more likely that the gecko arrived within luggage. As the early records from the island were aggregated within the tourist resort, it is most probable that this was the site of introduction. On the basis of tourist movements there is some probability that it has arrived from a distant Pacific I. site direct to Heron I. rather than from N Queensland, although the latter cannot be discounted. Being a parthenogenic species, it would be possible for the arrival of a single individual of *L. lugubris* to result in the establishment of the present expanding colony. The greater abundance of individuals in association with illuminated buildings is consistent with *L. lugubris* habitat usage on inhabited islands elsewhere in the Pacific (Petren, 1993). Indeed, the regular presence of small insects around these lights at night may have enhanced the survival of the gecko on Heron I. Whether the distribution of *L. lugubris* to as far south as the Barnard Is is natural or resulted from the extensive movement of fishing boats between islands of the northern Great Barrier Reef and Torres Strait during the 1800s is conjectural. In contrast, the Heron I. *L. lugubris* population clearly has arrived by anthropogenic means and represents an ~850km extension of range south of Mission Beach.

That terrestrial wildlife invades Heron I. via the materials and equipment brought to the island from Gladstone and other areas, is not surprising. What is surprising is that, apart from rodents, no non-avian vertebrates have successfully colonised Heron I. prior to this colonisation by *L. lugubris*. There is a range of genera of small skinks and geckos (*Carlia, Cryptoblepharus, Ctenotus, Lamphropholis, Gehyra, Heteronotia*) with species that occur in the coastal area of Gladstone and which, should they arrive at Heron I., could be expected to successfully colonise the island (in fact, a specimen of *Carlia schmeltzii* was collected in the tourist resort at Heron I. in 1998 by A. Congram). However, the abundance of terrestrially foraging, carnivorous/insectivorous avifauna such as egrets, rails and kingfishers may have a significant impact on survival of ground dwelling or diurnal species when they periodically arrive on Heron I. For sexually reproducing species, there is the additional limitation of multiple individuals of both sexes having to be present on the island at the same time. Other forested Capricorn-Bunker islands such as North West I., Wreck I., Fairfax I. and Lady Musgrave I. have a history of decades of human habitation and visitation and an abundance of reef egrets and landrails and kingfishers. The first three of these islands have been colonised by rodents but not by terrestrial reptiles.

The two reptiles that have colonised Capricorn-Bunker islands have been small, parthenogenic, nocturnal, arboreal geckos, *L. lugubris* on Heron I. and *H. frenatus* on Wilson I. Both species have a well established history of colonising new locations by traveling with people. In contrast, Lady Elliott I., a coral cay to the south of the Capricorn-Bunker Groups, was colonised by two species of small non-parthenogenic, terrestrial to partially arboreal, diurnal reptiles (Heatwole in Mather & Bennett, 1984). However, this island had been highly modified with an almost complete loss of trees since last century and, as a result, supported a depauperate population of egrets, rails and other potential predators of these reptiles (P. Ogilvie, pers. comm.). The characteristic avifauna of these forested coral cays of the southern Great Barrier Reef and the absence of reptile species living on the adjacent mainland that possess the suitable suite of coloniser characteristics (small, parthenogenic, nocturnal and aboreal) are presumed to have contributed to the restricted colonisation of the forested islands by terrestrial reptiles. That there is an element of randomness to colonisation events such as this is emphasised by the arrival of *L. lugubris* from a distant site rather than *H. frenatus* colonising Heron I. from nearby Wilson I.

ACKNOWLEDGEMENTS

Department of Environment staff (A. Congram, A. Hollis), Heron I. resort staff (S. Noonan, E. Grant, M. McKillop) and A. Phillott shared their observations of wildlife at Heron and adjacent islands. S. Noonan and L. Grant provided information of the movement patterns to the island for resort staff and guests. P. Ogilvie provided helpful comments during preparation of the manuscript. G. Shea and an unnamed person provided a constructive review of the manuscript. This assistance is gratefully acknowledged.

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